

Total Movements of the Air.—The following are the *largest* total movements recorded in miles at the Signal Service stations during the month: Delaware Breakwater, 13,730 miles; Cape May, 13,029; Wood's Holl, Mass., 12,987; Sandy Hook, 12,276; Thatcher's Island, Mass., 11,929; Cape Lookout, N. C., 10,668; Kittyhawk, N. C., 10,664; North Platte, 10,620; Cape Henry, 10,443; Indianola, Tex., 10,264; Breckenridge, Minn., 10,354; Barnegat, N. J., 10,134; Milwaukee, 9,965; Cheyenne, 9,894; Grand Haven, 9,793; Cape Hatteras, 9,757; Port Huron, 9,258; Erie, 9,069; Newport, 8,893. The *smallest* are: Stockton, Tex., 1,259 miles; Roseburg, Oregon, 2,055; Nashville, 2,105; Visalia, Cal., 2,151; La Mesilla, N. M., 2,181; Uvalde, Tex., 2,411; Santa Fé, 2,608; Deadwood, Dak., 2,634; Lynchburg, Va., 2,695; Augusta, Ga., 2,770; San Antonio, Tex., 3,343; Salt Lake City, 3,392; Portland, Or., 3,451; Olympia, Wash. Ter., 3,458; Silver City, N. M., 3,562; Boise City, Idaho, 3,602; Los Angeles, Cal., 3,700.

Local Storms.—Pilot Point, Tex., 24th, very severe wind storm, attaining a velocity of W. 59 miles, causing considerable damage to trees and fencing. Cincinnati, 18th, severe whirlwind of small diameter passed near the southern railway bridge, destroying considerable property. Nashville, 12th, during the progress of the heavy wind and rain storm, between the hours of 10 and 11 p. m., two small tornadoes were formed within the limits of the city; passing over it from SW. to NE., causing a large of destruction to property. The average width between the paths of the two storms was $1\frac{1}{2}$ miles, and over the central portion for a constant width of a $\frac{1}{2}$ mile no damage was done. The northern tornado commenced its work of destruction at a point about two miles southwest of the signal office, and passed to the northeast a distance of three or four miles, where all trace of the whirlwind's action disappeared. Property to the value of about \$30,000 was all destroyed in its path. Trees from $1\frac{1}{2}$ to 2 feet in diameter were uprooted or twisted off, and the debris carried in the direction of the whirl, which was from right to left. The southern tornado descended near Hillsboro Pike, where a small barn was first demolished, it then rose, passing entirely over several houses without injury, reaching the earth again in a short interval it moved to the Custom House, which it damaged to the amount of \$8,000; heavy blocks of stone weighing several tons were thrown from the walls, and the whole of one side torn down. After unroofing several buildings and destroying the spire of St. Pauls church the whirlwind disappeared. In the tracks of both tornadoes, the peculiar bounding action of the whirling cloud was easily discernable.

Sand Storms.—Umatilla, Or., 12th, 14th; Stockton, Tex., 12th, 24th; Ft. Garland, Col., 16th, 17th.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for February, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 88.0 per cent. The percentages for the four elements are: Weather, 90.0; Direction of the Wind, 86.3; Temperature, 88.2; Barometer, 87.5 per cent. By geographical districts they are: for New England, 88.3; Middle States, 92.2; South Atlantic States, 86.7; Eastern Gulf States, 88.8; Western Gulf States, 87.9; Lower Lake region, 90.2; Upper Lake region, 88.7; Tennessee and the Ohio valley, 87.2; Upper Mississippi valley, 84.0; Lower Missouri valley, 85.3; Northern Pacific region, 92.6; Central Pacific coast region, 93.1; Southern Pacific coast region, 92.9. There were 10 omissions to predict out of 3,567, or 0.28 per cent. Of the 3,557 predictions that have been made, 139, or 3.65 per cent, are considered to have entirely failed; 89, or 2.50 per cent, were one-fourth verified; 385, or 10.83 per cent, were one-half verified; 145, or 4.08 per cent, were three-fourths verified; 2,808, or 78.94 per cent, were fully verified, so far as can be ascertained from the tri-daily weather maps.

Cautionary Signals.—166 Cautionary Signals were displayed during the month, of which 156, or 94.0 per cent., were justified by winds of 25 miles per hour or over at, or within a radius of 100 miles of the station. 107 Off-shore Signals were displayed, of which 98, or 91.6 per cent, were fully justified; 106, or 99.1 per cent, were justified as to direction; 98, or 91.6 per cent as to velocity; and 1, or 0.9 per cent, were not justified either as to direction or velocity. 65 of the Off-shore were changed from Cautionary. 273 Signals of both kinds were displayed, of which 254, or 93.0 per cent, were fully justified. The above does not include signals ordered for 50 display stations, where the velocity is only estimated. 51 cases of winds of 25 miles and over per hour, from scattering stations, were reported, and for which signals had not been ordered.

NAVIGATION.

In the table on the right-hand side of chart No. III are given the highest and lowest readings of the Signal Service river-gauges for the month, with the dates of the same. The *Missouri* remained frozen over at Yankton until the 24th, when observations were resumed; at Omaha and Leavenworth the variation in the height of water has not exceeded 4 feet during the whole month. The *Mississippi* continued frozen at St. Paul and La Crosse throughout the month; thence southward to St. Louis the range at any station did not reach 4 feet for the entire month; at Cairo the river fell slowly from the 1st to the 11th; on the 13th it commenced to rise rapidly, and by the 24th had risen to 43 ft. 5 in., or 3 ft. 5 in. above the danger-line, after which it fell slowly to the end of the month, reaching 41 ft. 10 in. on the 29th; at Memphis it fell slowly from the 1st to 12th, after which it rose to the end of the month, when it was within 8 in. of danger-line; at Vicksburg it was within 1 ft. of danger-line (41 ft.) on the 1st, but continued slowly falling until the 17th, when it reached 27 ft. 3 in.; on the 18th it commenced rising, and at the end of the month

had reached 38 ft. 8 in.; at New Orleans it fell slowly from the beginning of the month to the 19th, after which it rose to end of month, when it was within 9 inches of danger-line. The *Ohio* at Pittsburg fell slowly from the 1st to the 10th; on the 12th it commenced to rise rapidly, and on the 14th reached 21 ft. 7 in., or 19 inches above danger-line, after which it fell slowly until the 26th, and remained low to end of month; at Cincinnati it fell slowly from the 1st to the 11th; on the 12th a rapid rise set in which continued to the 7th, when the water reached 53 ft. 3 in., or 39 inches above danger-line; it then fell slowly to end of month; at Louisville it remained almost stationary until the 14th, when a rapid rise set in, which on the 18th and 19th reached 30 ft. 6 in., or 6 ft. 6 in. above the danger-line, after which it fell rapidly to end of month. The *Tennessee* at Chattanooga continued low and almost stationary until the 14th, rose rapidly to the 17th, fell to 6 ft. on the 26th and rose slightly to end of month. The *Cumberland* at Nashville rose from the 1st to the 7th to 14 ft. 2 in., fell to the 11th to 10 ft. 4 in., after which it rose rapidly, and on the 19th and 20th reached 44 ft. 2 in., or 26 in. above danger-line, whence it fell to 14 ft. 10 in. on the 26th, and rose to 32 ft. 4 in. by end of month. The *Savannah* at Augusta rose 11 ft. on the 3rd, fell 11 ft. by the 9th, and remained almost stationary to end of month. On the *Red River* at Shreveport navigation has continued without interruption throughout the month, the river continuing to rise slowly from the 14th to the 29th; on the 15th the zero of river-gauge at this station was lowered 3 ft. 6 in., to correspond with the low water of 1879, but the readings given in the table for the present month are above the zero of 1878.

Ice in Rivers and Harbors.—The following notes respecting ice in rivers, &c., are of interest: *Columbia river*.—Umatilla, Or., 1st, 2nd, floating ice in river. *Missouri*.—Plattsmouth, Neb., 16th, ice broken up; 29th, ice gorge broke away from east half of pile bridge, and during the night river froze over the third time this month; L. Avenworth, floating ice 1st to 7th, clear of ice 8th, floating ice 21st. *Mississippi*.—St. Paul, river frozen over throughout the month. La Crosse, 9th, ice firm, crossing very good; 27th, ice getting thin, many large open places obstructing all travel. Davenport, floating ice 2nd, 4th to 10th, 18th, 24th, 18th to 22nd, 29th. Keokuk, heavy floating ice 1st to 10th, small quantities of ice 11th; 12th, ice breaking up along Illinois shore; 13th to 16th, heavy floating ice; 17th, river free; 19th, 29th, small quantities of ice; 20th to 23rd, heavy ice; 24th, river clear. Burlington, river full of floating ice 1st to 11th, 13th, 14th, 15th, 20th, 21st, 22nd; clear of ice 12th, 16th, 23rd. St. Louis, light floating ice 4th, 5th, 6th. *Rock River*.—Rockford, Ill., 17th, free of ice; 19th, small quantities of floating ice; 20th, river partly covered with thin ice; 21st, frozen over; 23rd, small quantities of floating ice; 24th, river clear. *Ohio*.—Wellsburg, W. Va., 5th, first ice in the river at this point this winter. *Monongahela*.—Morgantown, 5th, frozen over; 10th, ice breaking up; Pittsburg, 8th, floating ice. *Alleghany*.—Pittsburg, 8th, floating ice. *Susquehanna*.—Litchfield, Pa., 26th, river entirely clear of ice. *Delaware*.—Port Jervis, N. Y., 14th, floating ice; Philadelphia, 10th, ice formed in river during night. *Hudson*.—Albany, 16th, floating ice; 18th, nearly free of ice; 24th and 25th, full of floating ice; Ardenia, 28th, river entirely clear of ice, vessels moving. *Connecticut*.—Springfield, Mass., river free of ice throughout the month. *Lake Superior*.—Duluth, harbor frozen over 1st to 29th. Marquette, harbor covered with ice throughout the month. *Lake Michigan*.—Chicago, 1st, lake frozen; 2nd, ice breaking up; 4th, lake frozen; 10th, lake clear. *Grand River*.—Grand Haven, Mich., river frozen over or full of slush ice from 1st to 21st. *Lake Huron*.—Port Huron, 4th, ice-bridge formed across the bay from Ft. Gratiot Light House to Point Edwards; 9th, ice bridge broke to-day. *St. Clair River*.—Port Huron, 4th, clear of ice; 9th, 19th, floating ice. *Lake Erie*.—Cleveland, 5th, shore ice forming around the piers in the lake; 7th, 9th, large quantities of floating ice in lake and river. *Maumee River*.—Toledo, 2nd, covered with thin ice; 5th, frozen from shore to shore; 15th, free of ice; 20th, thin ice; 28th, schooner arrived from Cleveland. *Buffalo Creek*.—Buffalo, N. Y., 3rd, frozen over; 18th, ice broke up and passed out; 21st, frozen over; 25th, ice broken up. *Lake Champlain*.—Burlington, 1st, floating ice in lake; 2nd, harbor frozen over. Charlotte, Vt., 2nd, lake freezing over, ice-bridge firm; 6th, crossing ice on foot; 11th, teams crossing; 29th, lake still frozen. *High Tides*.—Atlantic City, N. J., 3rd; Sandy Hook, 3rd, carrying away jetty in front of office, and also the track of the N. J. Southern Railroad for several miles, all telegraphic communication interrupted for 24 hours.

TEMPERATURE OF WATER.

The temperature of water as observed in rivers and harbors, with average depths at which the observations were taken, are given in the table on left side of chart No. II. At the following stations observations were not made on the date indicated on account of ice: at Alpena, Duluth, Escanaba and Marquette no observations were made throughout the month; at Buffalo, 3rd to 18th, and 21st to 25th; Burlington, 2nd to 29th; Chicago, 1st, 2nd, 4th to 9th; Cleveland, 3rd; Detroit, 2nd to 11th, 13th to 17th and 19th to 22nd; at Grand Haven, 1st to 21st; New York city, 4th and 5th; Toledo, 5th to 11th. On account of breakage of thermometer no observations were made at San Francisco throughout the month, and at New York City from the 19th to 29th. Observations were commenced at Delaware Breakwater on the 15th.

ATMOSPHERIC ELECTRICITY.

Thunder-storms were reported in the various States and Territories on the following dates: New York, 12th, 18th, 20th, and 26th. South Atlantic States, 2nd, 3rd, 18th, and 19th. In the Gulf States, 12th, 13th, 14th, 18th and 24th. Tennessee and the Ohio valley, 11th, 12th, 13th, 18th and 28th. Upper Lake region, 11th, 12th, 18th, 22nd, 24th, 25th, 26th, 27th and 28th. Missouri, 11th, 12th, 13th, 18th, 24th, 25th and